BIOGRAPHICAL SKETCH

NAME Anbarasu Kannan	POSITION TITLE Scientist, Assistant Professor-AcSIR
ADDRESS Department of Protein Chemistry and Technology,CSIR-CFTRI,Mysuru, Karnataka	

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Thiruvalluvar University, India	B. Sc	2006	Biochemistry
Thiruvalluvar University, India	M. Sc	2008	Biochemistry
University of Madras, India	Ph. D.	2013	Cancer Biology
University of Texas Health Science Centre, Tyler, USA.	Postdoctoral Research Associate	2014-2017	Cancer Biology
CSIR-Central Food Technological Research Institute, Mysuru, Karnataka, India	Scientist	2018-Present	Cancer Biology, Exosomes- Biomarker Development

A. Personal Statement

My previous training in both Doctorate (2013) and Post-doctoral (from 2014-2017) have helped me to gain extensive knowledge on cancer research. During my Post-doctoral training, I have been working on exosome biogenesis, mitochondrial genetic alterations and dynamics in different cancers i.e., breast, prostate, Head and Neck. My research uncovered a novel 1) role of SH3GL2 in circulating exosomes regulating breast cancer development and progression. 2) Identified CTA-SPANXB1 as a novel prognostic biomarker and therapeutic target for Triple Negative Breast Cancer. 3) Identified genetic alterations of MUC16, SIRPA, HPV-16, HLA-DRB1 in circulating exosomes of Oropharyngeal Cancer. My work has been published in peer-reviewed journals. I have been awarded Early career Research Award (ECRA) in tracing the alteration signature of SH3GL2 in circulating exosomes of breast cancer progression to develop exosome based biomarker. My postdoctoral research laid the foundation in the field of exosome biogenesis and mitochondrial dynamics, and expending my expertise to develop exosome biomarkers for cancer diagnostics and therapeutics.

B. Positions and Honors

Positions and Employment

2014-2017 Post-Doctoral Research Associate, Department of Cellular and Molecular Biology, University of Texas Health Science Centre, Tyler, USA

2018 - Scientist, Assistant Professor –AcSIR, CSIR-Central Food Technological Research Institute, Mysuru, Karnataka, India

Other Training and Professional Memberships

Society for Mitochondrial Research and Medicine, India
Society for Mitochondrial Research and Medicine, USA
Society for Redox Biology and Medicine, USA
AFSTi – Life Member
Reviewer - Experimental cell research
Reviewer - Canadian Journal of Physiology and Pharmacology
Reviewer - BMC Cancer
Reviewer - Process Biochemistry
Reviewer - Long non coding RNA research
Reviewer – Journal of Biomolecular Structure and Dynamics
Reviewer – Food Science and Technology

Awards and Honors

2011 Best Poster Award ISGCON, INDIA

2019 Early Career Research Award (ECRA), DST-SERB, INDIA

2020 Two Best Poster Awards 8th International Translational Cancer Research Conference-Corresponding Author

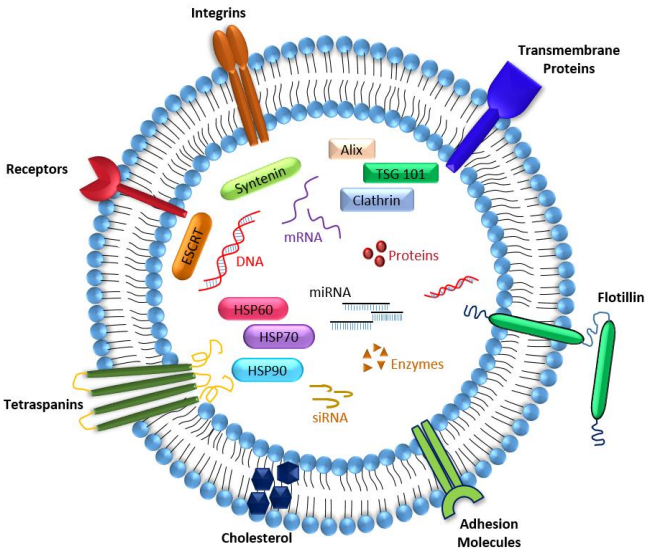
C. Research Interest

Exosome as biomarker for Cancer:

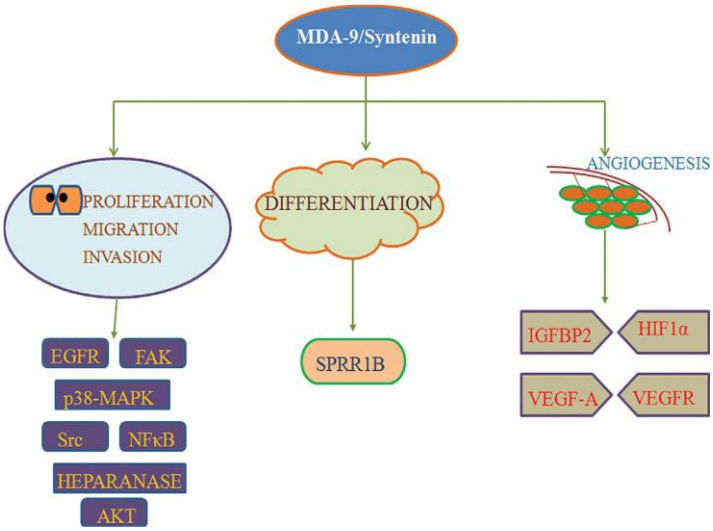
Exosomes are 50 to 200 nm, small secreted endocytic vesicles present in all cell types and body fluids. They are secreted by almost all types of cells under normal, physiological and pathological conditions. They are found in mostly all biological fluids such as breast milk, blood and urine. Exosomes are involved in cell-to-cell communication through the biological transfer of lipids, proteins, DNAs, RNAs, mRNAs and miRNAs. They are enriched in tetraspanins, enzymes, Heat Shock Proteins and membrane trafficking Proteins. Cancer exosomes carry survival information in the form of nucleic acids and proteins, shuttle constantly between the cancer cells through the circulation,

and influence growth and progression. Exosomes are emerging as a promising biomarker tool as they carry specific genetic information and influence tumor growth and progression. MDA-9/Syntenin is a multi-functional adapter protein regulating various important cellular processes including cell adhesion, membrane trafficking, neural development, immunoregulation, ubiquitination and exosome biogenesis. Syntenin is among the top 20 proteins most abundantly expressed in the exosomes and epithelial cell cancers. Thus, Syntenin could serve as a reliable exosome marker.

EXOSOMES



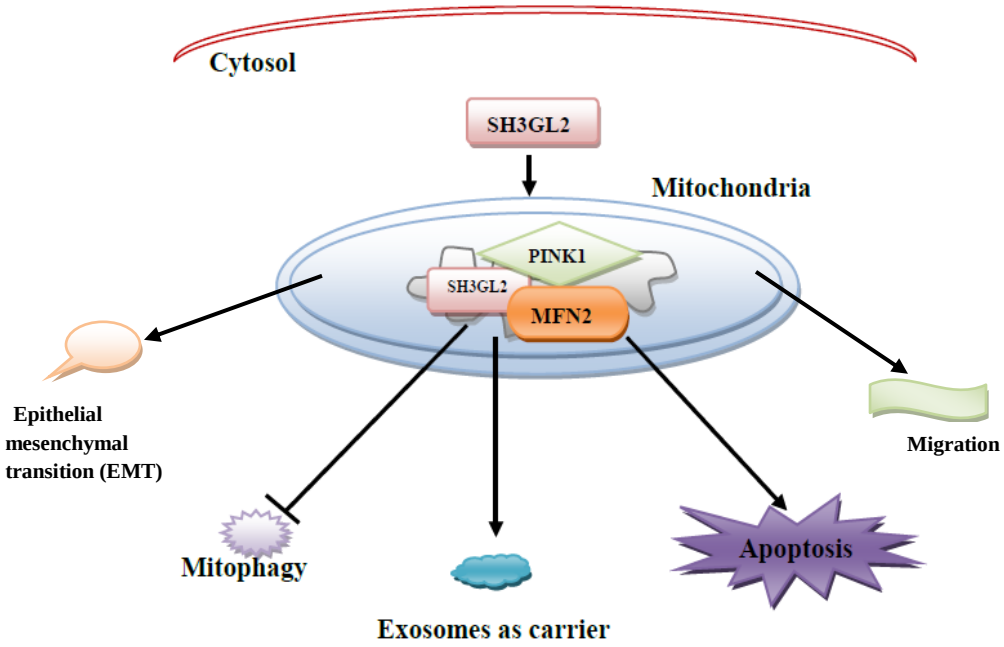
MDA-9: Exosome Biomarker



1. Mitochondrial Reprogramming in Circulating Exosomes

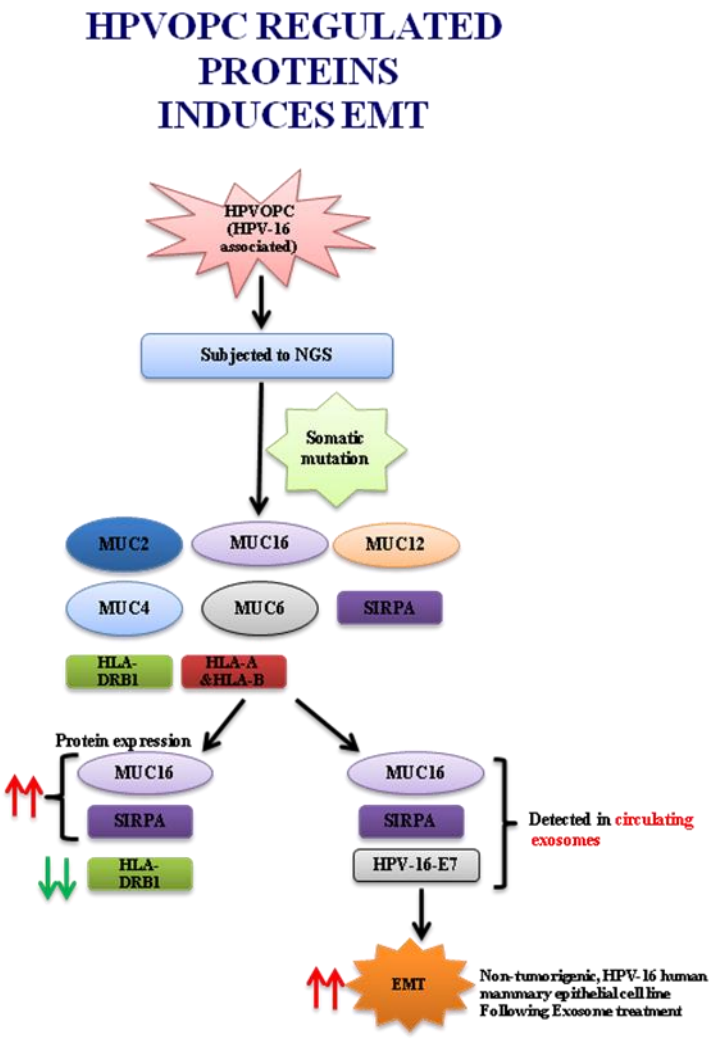
Recent review of the cancer genome landscape implicated that cancer mortality can be reduced to more than 70% by early detection and prevention. Abnormal mitochondrial function and reprogramming are implicated in biomarker development. Mitochondrial fusion is a process of fusion of damaged mitochondria to healthy ones. Mitochondrial biogenesis is a process involving replication of the mitochondrial genome and coordinated expression of both nuclear and mitochondria- encoded molecules and assembly of the oxidative phosphorylation complexes. Many factors, including MFN2, PINK1, PGC-1α and mitochondrial transcription factor A (MTTFA) play critical role in regulating mitochondrial fusion, biogenesis and maintaining mitochondrial integrity, but the role of mitochondrial fusion and biogenesis in cancer development and progression remains largely unknown. We identified SH3GL2, a vesicular endocytosis–associated protein as a potential breast cancer suppressor. We published that breast cancer cell derived exosomes carry SH3GL2 and MFN2 proteins and altered SH3GL2 and MFN2 expression is detectable in the exosomes. Our lab is further interested in studying how SH3GL2, PINK1, and MFN2 regulate mitophagy/mt fusion and prevent progression. Tracing their alteration signature in circulating exosomes will help us to develop exosome based biomarker for early cancer detection, monitoring and surveillance.

Current focus of the lab



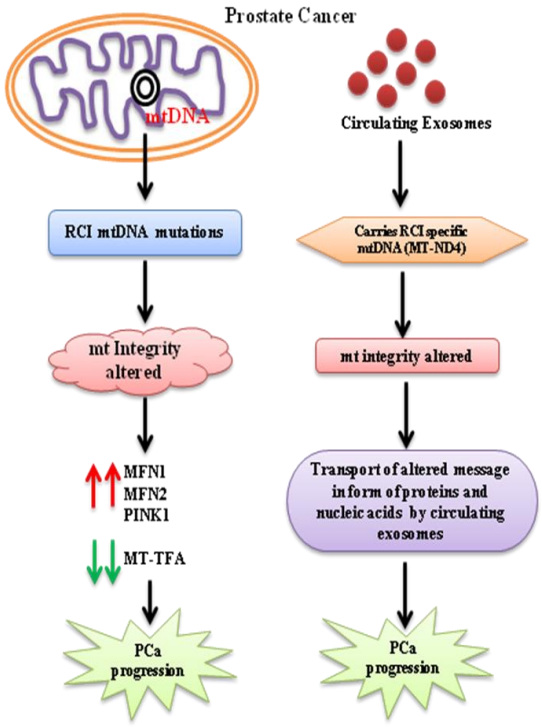
2. Elucidating the signaling mechanism regulating exosomes in Human Papilloma Virus induced tumorigenesis

Human papilloma virus is well regarded as a powerful microbe that can drive tumorigenesis by interacting with the human genome. Understanding the molecular pathogenesis of HPVOPC progression is critical for developing better disease management strategies. We found that whole genome sequencing analysis of Human papilloma virus-16 (HPV-16) associated oropharyngeal cancer (HPVOPC) patient uncovered new somatic mutation and MUC16, SIRPA accompanied by HPV-16-E7 protein expression was detected in circulating exosomes of some HPVOPC patients. And also these exosome secreted proteins enhanced invasion and induced EMT of non-tumorigenic mammary epithelial cells. Our lab currently focuses on how HPV derived exosomes from human sera influences epithelial mesenchymal transition (EMT) and migration in Ovarian, Cervical and Head & Neck cancer progression.



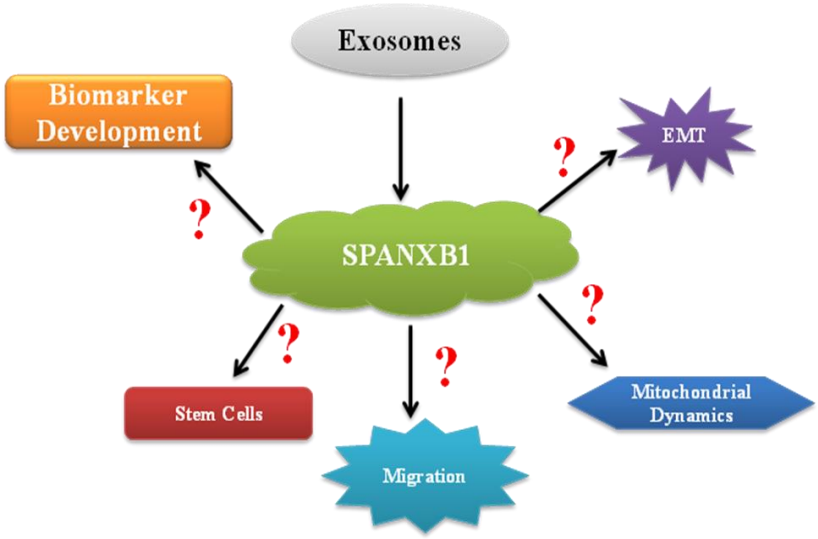
3. Mitochondrial Dynamics in tumor microenvironment

Mitochondrial (mt) energy balance and reprogramming are hallmarks in cancer progression and implicated in biomarker development. The mtDNA mutation may influence mt fusion and fission which is important mechanisms for maintaining mt homeostasis and function. We have detected pathogenic RCI targeted mtDNA mutations and altered mt integrity following mtDNA depletion in Prostate Cancer (PCa). The circulating exosomes from PCa sera carried RCI-mtDNA and mt integrity associated proteins and co-localized with the mt in the PCa cells. Pathogenic mtDNA mutation from RCI and their detection in the circulating exosomes could be an invaluable tool for early PCa detection, monitoring and surveillance. Our lab at present focuses how mutation in mtDNA and mt proteins in the circulating exosomes implicated their usefulness for biomarker development in various cancers.



4. SPANXB1 in the regulation of migration, EMT and metastasis of cancer

We identified that cancer testis antigen (CTA) *SPANXB1* is a downstream target of metastases suppressor SH3GL2. Depletion of SPANXB1 in Triple Negative breast cancer (TNBC) models markedly reduced migration, invasion and reactive oxygen species production. We also found that Cancer Testis Antigen - SPANXB1 as a novel and ideal therapeutic target for blocking Triple Negative Breast Cancer metastases due to its unique expression pattern and function as an EV based prognostic marker for improving TNBC survival. Our future direction in lab is to scrutinize the SPANXB1 regulation and its signaling mechanism in tumor microenvironment in various cancers for biomarker development.



5. Exosome mediated delivery of bioactive molecules for cancer

To explore the use of exosomes as carrier to deliver the food derived bioactive molecules for the treatment of cancer.

D. Publications

Original Research Publications

1. **Kannan A**, Philly JV, Hertweck KL, Ndetan H, Singh KP, Sivakumar S, Wells RB, Vadlamudi RK, Dasgupta S. Cancer Testis Antigen Promotes Triple Negative Brest Cancer Metastasis and is Traceable in the Circulating Extracellular Vesicles. Sci Rep. 2019 Aug 12;9(1):11632. Doi: 10.1038/s41598-019-48064-w.
2. Philley JV, **Kannan A**, Olusola P, McGaha P, Singh KP, Samten B, Griffith DE, Dasgupta S. Microbiome diversity in sputum of nontuberculous mycobacteria infected women with a history of breast cancer. Cell PhysiolBiochem. 2019;52(2):263-279. Doi: 10.33594/000000020.
3. Philley JV, Hertweck KL, **Kannan A**, Brown-Elliott BA, Wallace RJ Jr, Kurdowska A, Ndetan H, Singh Kp, Miller EJ, Griffith DE, Dasgupta S. Sputum Detection of Predisposing Genetic Mutations in Women with Pulmonary Nontuberculous Mycobacterial Disease. Sci Rep. 2018 Jul 27;8(1): 11336. doi: 10.1038/s41598-018-29471-x.
4. **Kannan A**, Hertweck KL, Philly JV, Wells RB, Dasgupta S. Genetic Mutation and Exosome Signature of Human Papilloma Virus Associated Oropharyngeal Cancer. Sci Rep. 2017 Apr 6; 7:46012. doi: 10.1038/srep46102.
5. Philley JV, **Kannan A**, Griffith DE, Devine MS, Benwill J, Wallace RJ Jr, Brown-Elliott BA, Thakkar F, Taskar V, Fox JG, Alqaid A, Bains H, Gupta S, Dasgupta S. Exosome Secretome and Mediated Signaling in Breast Cancer Patients with Nontuberculous Mycobacterial Disease. Oncotarget. 2017 Mar 14;8(11):18070-18081. doi: 10.18632/oncotarget. 14964.
6. Perumal N, Perumal M, **Kannan A**, Subramani K, Halagowder D, Sivasithamparam N. Morin Impedes Yap nuclear translocation and fosters apoptosis through suppression of Wnt/beta-catenin and NF-kB signaling in Mst1 over expressed HepG2 cells. Exp Cell Res. 2017 Jun 15;355(2):124-141. doi: 10.1016/j.yexcr.2017.03.062. Epub 2017 Mar 31.
7. **Kannan A**, Robert B Wells, Shivkumar S, Komatsu S, Singh KP, Samten B, Philley JV, Sauter ER, Ikebe M, Idell S, Gupta S, Dasgupta S.Mitochondrial Reprogramming Regulates Breast Cancer Progression. Clin Cancer Res. 2016 Jul 1; 22(13):3348-60. doi: 10.1158/1078-0432.CCR-15-2456.
8. Philley JV, **Kannan A**, Dasgupta S. MDA-9/Syntenin Control. J Cell Physiol.2016 231(3):545-50.
9. Philley JV, **Kannan A**, Qin W, Sauter ER, Ikebe M, Hertweck KL, Troyer DA, Semmes OJ, Dasgupta S. Complex-I alteration and enhanced mitochondrial fusion are associated with prostate cancer progression. J Cell Physiol. 2015 Nov 4. Doi:10.1002/jcp.25240.

10. Iyer S.C, **Kannan, A**, Gopal, A, Devaraj, N, Devaraj, H. "Receptor channel TRPC6 orchestrate the activation of human hepatic stellate cell under hypoxia condition", 2015, Exp Cell Res, 2015, 336: 66-75.
11. T. Muthukumar, D. Prakash, **K. Anbarasu**, T. P. Sastry. Down regulation of MMPs and inflammatory markers by the collagen sponge incorporated with *Macrotyloma uniform* on full thickness wound healing. *RSC Advances* 4 (2014) 64267-64276.
12. T. Muthukumar, **K. Anbarasu**, D. Prakash, T.P. Sastry, Effect of growth factors and pro-inflammatory cytokines by the collagen biocomposite dressing material containing *Macrotylomauniflorum*plant extract - in vivo wound healing. *Colloids and Surfaces B: Biointerfaces*121 (2014) 178–188.
13. **Anbarasu K,** Arunkumar Krishnan , Mohammed Ali, Shyama Subramaniam, DevarajHalagowder, NiranjaliDevarajSivasithamparam. Caveolin 1 promotes gastric cancer progression by up-regulating epithelial to mesenchymal transition by crosstalk of signaling mechanisms under hypoxia condition. *European Journal of Cancer* 2013, doi: 10.1016/j.ejca.2013.08.016.
14. SubramaniyaBharathi Raja, Malliga Raman Murali, G.K. Malathi, **K. Anbarasu** and S. NiranjaliDevaraj. Effect of Aqueous Extract of *Aegle marmelos*Fruit on Adherence and β-Lactam Resistance of *Enteropathogenic Escherichia coli* by Down Regulating Outer Membrane Protein C.*Am J Infect Dis* 5 (2): 161-169.

Genbank

1. **Anbarasu K,** Sivakumar S, Shyama S, Devaraj H and NiranjaliDevaraj S. Homo sapiens TNF receptor-associated potein-1 (TRAP1) mRNA, partial cds. GenBank: Aug 2012: JX481354.1.
2. **Anbarasu K,** Sivakumar S, Shyama S, Devaraj H and NiranjaliDevaraj S. TNF receptor-associated potein-1 (Homo sapiens). GenBank: Aug 2012: AFS69159.1.

Complete List of Published Papers in google scholar:

https://scholar.google.com/citations?user=VW4MhY8AAAAJ&hl=en

E. Invited Talks – 05

F. Ongoing Research

1. Awarded **Early Career Research Award (ECRA)** from DST-SERB, Government of India on **"Mitochondrial fusion associated with mitophagy and exosomes: A novel biomarker development and therapeutics in breast cancer progression"** from May 2019 to May 2022 - **PI**

2. Design and development of reactor for processing of coconut based beverages with UV- C Irradiation from CDB, 2019 to 2021 – **Co-PI**

3. Translation of pre-clinically tested probiotic formulation to human population with emphasis on immune-modulation and gut from CSIR, 2019to 2021 - **Member**

Lab Members

1. Kaumudi Pande – CSIR-JRF
2. Mubthasima PP – CSIR-JRF
3. Rajalakshmi P – Project Assistant Level II- DST,SERB

Dissertation Students

Current students – 4

Completed students - 1